

## CLAIMS

What is claimed is:

- 1           1.       A device for sensing NO<sub>x</sub> compounds comprising:  
2 a calix[4]arene compound capable of forming a complex with at least one NO<sup>+</sup> cation,  
3 wherein a detectable charge-transfer reaction occurs between the NO<sup>+</sup> cation and the  
4 calix[4]arene.
- 1           2.       The device of claim 1, wherein the detection is selected from the group  
2 consisting of visualization, measurement of electrochemical changes, and measurement of  
3 spectroscopic changes.
- 1           3.       The device of claim 1, wherein the complex undergoes dissociation.
- 1           4.       The device of claim 3, wherein the complex is decolorized.
- 1           5.       The device of claim 1, wherein the calix[4]arene compound is alternatively a  
2 cone calix[4]arene, a 1, 3-alternate calixarene or a combination thereof.
- 1           6.       The device of claim 1, wherein the calix[4]arene compound is optionally  
2 immobilized, in solution, attached to a ligand, attached to a solid support, or any combination  
3 thereof.
- 1           7.       The device of claim 1, wherein the NO<sub>x</sub> compounds are optionally a gas,  
2 liquid, solution, mixtures of gases, or a combination thereof.
- 1           8.       The device of claim 1, wherein the complex is a storage device for the NO<sup>+</sup>  
2 cation.
- 1           9.       The device of claim 1, wherein the complex is capable of transferring the NO<sup>+</sup>  
2 cation to a substrate.
- 1           10.      The device of claim 1, wherein the complex is stabilized by one or more  
2 Lewis acids.

1

- 1           11.     A device for purifying chemical compounds containing NO<sub>x</sub> comprising:  
2                 a calix[4]arene compound, wherein the calix[4]arene compound complexes a NO<sup>+</sup>  
3 cation from the chemical compound and is capable of transferring the NO<sup>+</sup> cation produced  
4 from the NO<sub>x</sub>.
- 1           12.     The device of claim 11, wherein the calix[4]arene compound is optionally  
2 immobilized, in solution, attached to a ligand, on a solid interface, attached to a solid support,  
3 or a combination thereof.
- 1           13.     The device of claim 11, wherein the complex is a storage device for the NO<sup>+</sup>  
2 cation.
- 1           14.     The device of claim 13, wherein the complex is chemically stable for at least  
2 several weeks.
- 1           15.     A method of purifying chemical compounds comprising:  
2                 exposing a calix[4]arene compound to a mixture of chemical species;  
3                 allowing the calix[4]arene compound to interact with the mixture, wherein the  
4 calix[4]arene compound forms an NO<sup>+</sup> complex.
- 1           16.     A molecular container comprising:  
2                 a calix[4]arene compound; and  
3                 at least one NO<sup>+</sup> cation.
- 1           17.     The molecular container of claim 16, wherein the calix[4]arene compound  
2 complexes the NO<sup>+</sup> cation and is capable of storing it.
- 1           18.     The molecular container of claim 16, wherein the calix[4]arene compound  
2 complexes the NO<sup>+</sup> cation and is capable of transferring it to another substrate
- 1           19.     An optical switch comprising:  
2                 a calix[4]arene-nitrosonium complex in which the nitrosonium is capable of changing  
3 between a free and complexed state wherein the switching can be detected optically.

- 1           20.     An optical switch comprising:
- 2           a means for complexing a nitrosonium cation; and
- 3           a means for detecting the presence of the complex.